

# Understanding and experience of climate change in rural general practice in Aotearoa—New Zealand

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**Background:** Climate change is already affecting Aotearoa New Zealand (Aotearoa-NZ). The public health effects are varied and complex, and rural primary care staff will be at the front line of effects and responses. However, little is known about their understanding and experience.

**Objectives:** To determine understanding, experiences and preparedness of rural general practice staff in Aotearoa-NZ about climate change and health equity.

**Methods:** A mixed-methods national cross-sectional survey of rural general practice staff was undertaken that included Likert-style and free-text responses. Quantitative data were analysed with simple descriptive analysis and qualitative data were thematically analysed using a deductive framework based on Te Whare Tapa Whā.

**Results:** A proportion of survey respondents remained unsure about climate science and health links, although many others already reported a range of negative climate change health impacts on their communities, and expected these to worsen. Twenty to thirty percent of respondents lacked confidence in their health service's capability to provide support following extreme weather. Themes included acknowledgement that the health effects of climate change are highly varied and complex, that the health risks for rural communities combine climate change and wider environmental degradation and that climate change will exacerbate existing health inequities.

**Conclusions:** The study adds to sparse information on climate change effects on health in rural primary care. We suggest that tailored professional education on climate change science and rural health equity is still needed, while urgent resourcing and training for interagency disaster response within rural and remote communities is needed.

**Key words:** climate change, health inequities, natural disasters, primary health care, rural health

## Introduction

Temperatures within Aotearoa New Zealand (Aotearoa-NZ) have risen 1.1 °C between 1910 and 2020.<sup>1</sup> The Aotearoa-NZ population is already exposed to more frequent heat extremes, marine heatwaves, heavy rainfall events, and extreme fire weather days.<sup>1</sup> The severity, frequency, and geographic distribution of adverse weather events in Australasia are projected to increase, with modelling suggesting temperature increases between 1.5 and 4 °C, dependent on mitigation responses.<sup>1</sup> The recently released Intergovernmental Panel on Climate Change report (IPCC 2022) indicated, at the current rate of increase, a temperature rise of 1.5 °C between 2030 and 2052.<sup>1</sup> Even with global temperature rise limited to 1.5 °C, substantial effects will still be experienced in Aotearoa-NZ: more hot days and fewer cold days, sea level rise and coastal erosion, prolonged marine heatwaves, significant glacier recession, more droughts and extreme fire weather days, increasing rainfall intensity, and regional changes to seasonal precipitation patterns.<sup>2</sup>

The health impacts of climate change are substantial and overwhelm small cold-related mortality savings. Direct effects include rising heatwave-related mortality, worsened cardiovascular and respiratory disease management, poorer drinking water quality and supply issues, and the emergence of tropical diseases; these are the principal health issues associated

with rising temperatures in Aotearoa-NZ.<sup>2,3</sup> Indirect effects through the social and environmental determinants of health include: housing stress, loss of livelihood, food insecurity, changing demographics, community isolation, and societal dysfunction.<sup>4</sup>

Rurally, climate change will exacerbate existing poor access to health care and other goods and services, as well as preexisting urban–rural socioeconomic inequalities.<sup>5,6</sup> Compared with urban populations, rural communities will be affected earlier and more severely, for a range of reasons: climate-threatened primary industry livelihoods (farming, fishing, forestry); high vulnerability of remote coastal communities to sea level rise and coastal erosion; poorer quality housing in low income rural communities; reliance on untreated drinking water sources; and critical infrastructure vulnerabilities (such as electricity and transport links).<sup>7–9</sup> Perhaps more importantly, rural areas have an overall higher percentage of Māori compared with urban areas.<sup>7</sup> Māori, the Indigenous people of Aotearoa-NZ, experience inequitable health outcomes due to the ongoing effects of colonization and racism.<sup>10</sup> For Māori, climate change will further exacerbate the loss of traditional lands, resources, food gathering sites, and traditional practices already caused by colonization.<sup>10</sup> The health system has a responsibility under the 1,840 treaty between Māori and the Crown (te Tiriti o Waitangi) to

## Key messages

- Most rural general practice staff surveyed understand climate change science.
- There was strong concern of community isolation after adverse weather events.
- Climate change effects on health inequities are poorly understood by respondents.
- Climate change and health advocacy were identified as important by most respondents.

actively protect Māori health and wellbeing and to achieve equitable health outcomes. Climate change is likely to be a major barrier to achieving equitable health outcomes for Māori. It is imperative that primary care work alongside Māori communities to ensure available health services and resources support their health needs in this climate-changing landscape.

Strong primary care systems reduce health inequities and lead to better health outcomes for populations.<sup>11</sup> Therefore, rural primary care has an important role to play in protecting health from climate change for rural populations. The rural general practice workforce also has the potential to be a powerful advocacy group for change. There is a growing body of evidence demonstrating that health arguments can increase public and political support for climate action, as well as exhortations by global health leaders that health professional climate action is an ethical duty.<sup>12</sup> Rural Aotearoa-NZ is a particularly important potential site for such activism. Intensive dairy farming is our greatest source of climate and water pollution nationally, and agri-business lobbying has long blocked meaningful climate policy in Aotearoa-NZ.<sup>13</sup> While many farmers are influenced by agri-business leaders, many are also innovating in continued care for land, water, climate, and community health. The voices of respected rural health workers could therefore add weight to rural support for climate action.

Despite being at the frontline of this profound public health challenge, very little is known globally or in Aotearoa-NZ about the local health effects of climate change in rural primary care settings, rural clinicians' knowledge of climate change science, their preparedness, or their resource needs. In a rare survey of rural general practice in 1 region of Australia, Purcell and McGirr<sup>14</sup> identified respondents' concern for rural health service preparedness and inadequate disaster response planning.<sup>14</sup> They recommended capacity building to respond to extreme weather events and natural disasters, and to address mental health issues and socioeconomic disadvantage, as well as to advocate for healthy climate action.<sup>14</sup>

To address this dearth of research, we aimed to undertake the first national survey in Aotearoa-NZ to explore rural general practice understanding and experience of climate change, including the perceptions of general practice staff of their role in climate health advocacy.

## Methods

An online, self-administered survey was distributed nationally to rural general practice staff in Aotearoa-NZ. To meet inclusion criteria, survey participants were required to identify as working in Aotearoa-NZ in a rural setting in one of the following roles: general practitioner (GP), GP registrar, house officer (PGY2/3), practice manager, nurse practitioner, or practice nurse.

The survey was distributed electronically through several primary care member organizations, including Hauora Taiwhenua (previously the Rural General Practice Network), the Rural Chapter of the Royal New Zealand College of General Practitioners (RNZCGP), through the RNZCGP ePulse newsletter, and the Rural Nurses New Zealand Facebook group. A snowballing approach was not utilized. We also directly emailed and phoned general practices (but not rural hospitals) that were located on Google Maps in designated rural areas (based on the Geographic Classification for Health [GCH]).<sup>15</sup> Recruitment and data collection took place over the months of November and December 2021 to coincide with the summer studentship funding of the first author. The size of the source population is difficult to determine. A recent GP workforce survey estimated the rural GP workforce at 760.<sup>16</sup> The number of individual rural practices identified through the GCH was 138. Due to ethical limitations on confidentiality, the addresses of participants were not captured in the survey and could therefore not be classified by the GCH. Respondents self-identified whether they were rural, urban, or neither rural nor urban.

The survey was adapted from Purcell and McGirr.<sup>14</sup> Demographics included age bracket, gender identity, professional role, and practice type. It included 12 questions covering the following areas: familiarity with climate change science and its links to health; local climate health effects already experienced and expected; effects on health equity; preparedness for severe weather events; and views on health advocacy. The survey included Likert scales and free-text responses. We integrated a Māori model of health (Te Whare Tapa Whā) to provide a framework of 4 broad pillars of health for survey respondents' experiences and predictions of climate change's impacts on health within their communities.<sup>17</sup> Te Whare Tapa Whā is a holistic model of health used widely in Aotearoa-NZ health care. Our use of Te Whare Tapa Whā was guided by 2 of the authors, who are Māori. The remaining 3 authors are of European descent. The survey was additionally checked with Te Rōpū Ārahi, Hauora Taiwhenua's Māori governance group, and further refined. The full survey is available in [Supplementary Material](#).

Quantitative data were analysed via simple descriptive statistics and inferential tests (Fisher's exact test, Z-test). For qualitative data, we used a mixed deductive-inductive content analysis approach.<sup>18</sup> The 4 pillars of Te Whare Tapa Whā—physical, spiritual, mental, and family health—were used to frame deductive coding of identified health effects, while further thematic codes were drawn out inductively. Data were coded by the first author and checked with the other authors. Preliminary themes were developed and then checked with Te Rōpū Ārahi before further refinement. Both quantitative and qualitative data were integrated through iterative triangulation to generate a broad conceptual understanding of climate change knowledge and experiences among participants.<sup>19</sup>

The study was approved by the Human Ethics Committee at the University of Otago (reference number D21/377). The participant information sheet was provided at the start of the survey, with individuals having to consent to proceed to the survey questions. Funding was provided by a grant from the Rural General Practice Network.

## Results

Seventy individuals responded to the survey, of whom 4 were excluded for working in an “urban” or “not clearly urban or rural” setting. Of the participants, 53% ( $n = 35$ ) were GPs, giving an indicative response rate of approximately 5%. Demographic data for the 66 eligible survey respondents are presented in [Table 1](#).

Although a large majority of survey respondents understood that current global temperatures are higher than they were in preindustrial times (85%,  $n = 56$ ), and that anthropogenic greenhouse gas emissions were responsible (86%,  $n =$

**Table 1.** Demographics of survey respondents (2021).

Demographic item	Survey respondents, % ( <i>n</i> )
Total	100 (66)
Gender identity	
Male	35 (23)
Female	65 (43)
Gender diverse	0 (0)
Prefer not to say	0 (0)
Age bracket	
25–34 years	3 (2)
35–44 years	24 (16)
45–54 years	27 (18)
55–64 years	33 (22)
65+ years	12 (8)
General practice role	
GP	53 (35)
General practice registrar	3 (2)
Nurse practitioner	6 (4)
Practice nurse	15 (10)
Practice manager	21 (14)
Did not self-identify	1.5 (1)
Ethnicity	
European/Pākehā	73 (48)
Māori	5 (3)
Pacific Peoples	0 (0)
Other <sup>a</sup>	26 (17)
General practice ownership model	
Community trust	21 (14)
Corporate	5 (3)
DHB	6 (4)
GP	52 (34)
Māori health provider	9 (6)
Other	8 (5)

<sup>a</sup>Other ethnicity included: American, Australian European, British, British Japanese, Canadian European, Dutch, English, Irish, Latin American, Other European, and Scottish.

57), this left a small proportion who were unsure about climate science (11%–12%) and an even smaller proportion rejecting climate science evidence and links to health ( $\leq 5\%$ ). Very similar proportions were seen for statements about climate change having substantial effects on public health (82%,  $n = 54$  agreeing, 17% neither agreeing nor disagreeing). About two-thirds (65%,  $n = 43$ ) agreed that the frequency and intensity of extreme weather events was already changing in their region, with a substantial number (30%,  $n = 20$ ), neither agreeing nor disagreeing. A slim majority (56%) of respondents believed that climate change would cause poor health outcomes *inequitably* within their communities, whilst a quarter of respondents (26%) were unsure and 17% did not consider that climate change would create or worsen inequities.

Similarly, a substantial proportion of respondents were uncertain about whether health outcomes across the 4 pillars of Te Whare Tapa Whā were currently being impacted by climate change (Table 2). However, participants became significantly more confident that effects would occur in the future.

Although the majority of respondents indicated that their health service was capable of an initial response to an extreme weather event, there was a suggestion that their confidence in long-term capability for support, following an extreme weather event, was lower (Table 3).

Strengthening acute disaster capacity response was identified by the majority of respondents as the preferred resource that would be useful in their health services' response to a natural disaster or extreme weather event (Table 4).

Despite advocacy in these contexts existing outside of the typical remit of respondents' rural general practice roles, there was a strong interest and sense of importance attributed to advocating on these topics. Most respondents acknowledged the importance of advocating about health issues in the context of natural disasters and extreme weather events (66%,  $n = 43$ ), health issues related to a changing climate (78%,  $n = 51$ ), social issues related to a changing climate (80%,  $n = 52$ ) and actions to reduce climate pollution (66%,  $n = 43$ ), with no significant differences in willingness to advocate between professional groups.

Theme 1: current and predicted health effects of climate change are highly varied and complex

Respondents discussed a range of climate change health effects already happening, and that as climate change worsens,

**Table 2.** Rural general practice staff perceptions on the negative impact of climate change on current and future health outcomes within their local communities (2021).

Te Whare Tapa Whā pillar of health	Climate change likely or definitely likely to be currently impacting the health outcome, % ( <i>n</i> )	Climate change likely or definitely likely to impact health outcome in the future, % ( <i>n</i> )
Taha tinana— physical health	59 (39)	85 (56)*
Taha wairua— spiritual health	55 (36)	76 (50)*
Taha whānau— family health	41 (27)	74 (49)*
Taha hinengaro— mental health	55 (36)	74 (49)*

\* $P < 0.01$ , 1-tailed Z-test.

**Table 3.** Perceived ability of survey respondents' health service to provide health services following an extreme weather event (2021).

	Extremely unlikely, % ( <i>n</i> )	Somewhat unlikely, % ( <i>n</i> )	Neither likely nor unlikely, % ( <i>n</i> )	Somewhat likely, % ( <i>n</i> )	Extremely likely, % ( <i>n</i> )
Providing an initial emergency response	11 (7)	6 (4)	6 (4)	41 (27)	36 (24)
Providing services during the first few weeks	8 (5)	9 (6)	3 (2)	47 (31)	33 (22)
Providing services to respond to long-term effects	11 (7)	12 (8)	8 (5)	44 (29)	26 (17)

**Table 4.** Survey respondents' top 3 resources which would be most useful for their health service in responding to an extreme weather event (2021).

Rank	Resource	Selected by % ( <i>n</i> )
1	Acute disaster capacity response	77 (51)
2	Interagency cooperation	56 (37)
3	Long-term disaster recovery phase planning	48 (32)
4	Partnership with iwi/hapū	35 (23)
5	Community health promotion and awareness programmes	29 (19)
6	Central government leadership	24 (16)

the health effects would become more profound, complex and integrated, blurring distinctions between the pillars of Te Whare Tapa Whā (Table 5).

Three further themes resulted from the inductive analysis: climate change in the context of wider environmental degradation affecting rural health; climate change will exacerbate existing health inequities; and past experiences of adverse weather events raised concern for community preparedness.

## Theme 2: rural community health risks combine climate change and wider environmental degradation

Participants felt that the health impacts of climate change (current and predicted) were compounded by other human causes of environmental degradation. One respondent recognized the difficulty in attributing the root cause(s) of ill health in their community:

Other environmental impacts, such as degradation of waterways and ocean sedimentation, which may not be directly linked to climate change, clearly play a role. It's a bit beyond my training and knowledge to understand exactly what impacts relate to climate change and what is caused by landscape modification. [GP25]

A range of interacting anthropogenic environmental effects were highlighted by many, who cited pollution to air, water, and soil; the introduction of pest species; native species loss; overfishing; and the overconsumption of natural resources. For many, these were interlinked with climate change's effects.

Anything that affects the quality of life will affect the health of the community but it is not only climate change. Other

things, such as degradation of bush by pests (including cats, weasels, stoats, wild pigs, wallabies, mynahs and almost every introduced species) will also impact health. [GP24]

## Theme 3: climate change will exacerbate existing health inequities

The respondents who agreed that climate change would cause or exacerbate existing health inequities were asked to explain which group(s) would likely be affected.

Many respondents recognized that Māori were likely to be inequitably affected by climate change because of existing socioeconomic inequities; ancestral connections with land and sea; sea level rise causing a loss of cultural sites; effects on traditional food gathering (mahinga kai and moana kai); increased risk of food insecurity; inequities in the prevalence of chronic cardiorespiratory conditions; increased rates of insecure employment and seasonal work, and greater likelihood of living in substandard, overcrowded housing.

The elderly were also identified by many as being particularly vulnerable to heat stress:

Elderly/vulnerable people dying due to heat-related illnesses (e.g. more sudden deaths and the economic disruption that causes). [GP13]

The health of farmers and workers in the agricultural and horticultural sectors was considered to be already inequitably affected by severe weather events:

Increasing severity and frequency of droughts has a major impact on the mental health and wellbeing of rural farmers because it threatens the welfare of their stock and leads to stress and financial insecurity. [GP27]

A wide range of other groups were also identified, including individuals with chronic cardiorespiratory conditions; families with coastal dwellings or dwellings in flood-prone areas; families in substandard overcrowded housing; individuals living in poverty; the unemployed; the homeless; Pacific peoples and other immigrant communities; children and young adults; individuals reliant on subsistence food gathering; individuals dependent on daily medical care, and highly isolated and remote communities.

## Theme 4: experiences of adverse weather events raises concern for preparedness and recovery

The final theme drew from the lived experience of previous community isolation following an adverse weather event.



**Table 5.** Survey respondents' current and predicted health effects of climate change coded by Te Whare Tapa Whā Māori model of health (2021).

Te Whare Tapa Whā pillar of health		
Taha tinana Physical health	Current health effects of climate change	Heat stress; skin damage and skin cancer; poor eczema control; increase in bed bugs and bites; increase in skin infections and allergies; increase in frequency and severity of asthma and other respiratory diseases; chronic ill health worsened; poorer quality of life for those with cardio-respiratory diseases
	Additional health effects predicted	Decreased water quality causing water-borne illness; contaminated drinking water supplies; increased risk of importing malaria and dengue fever as temperatures rise; injury and death from extreme weather events
Taha wairua Spiritual health	Current health effects of climate change	Death of native forest and rongoā māori (traditional healing); reduction in local mahinga kai and kai moana (traditional food gathering)
	Additional health effects predicted	Sea level rise causing disconnect from land for coastal dwellers; homelessness; global migrations
Taha whānau Family health	Current health effects of climate change	Extreme weather events causing loss of homes, livelihoods, and community infrastructure; isolation from adverse weather event reducing family access to health care services; financial insecurity
	Additional health effects predicted	No additional family health impacts identified
Taha hinengaro Mental health	Current health effects of climate change	Fear of climate change causing anxiety, especially in youth; sense of doom and sense of individual powerlessness to effect positive change; stress and depression in farmers following adverse weather events or droughts; climate change debate causing community polarization
	Additional health effects predicted	Social unrest; societal dysfunction

Some respondents that had experienced such an event in the recent past were still dealing with the after-effects, with one noting:

Significant weather event damaged the only road to our community > 3 years ago. Ongoing access issues while this is still being repaired—impacts on acute transfers; hospital visits etc [GP18]

Previous experiences informed descriptions of adverse weather event effects on rural communities, including fragile food and water supply, stress and anxiety, workforce pressures, and reduced access to health care.

As past experiences have shown, we are usually left somewhat unsupported initially in an emergency response due to being a rural practice. We find ourselves having to be self sufficient for the majority of any emergency response, be it fire, pandemic, etc. Once the dust settles so to speak then support does kick in. [PM14]

Respondents identified a range of resources that could alleviate these impacts, such as medical centres with independent power supply; a dedicated and well-equipped emergency evacuation centre; and interagency cooperation in emergency response planning and practice. There were frequent calls for increased funding to rural primary care and growing the rural health workforce.

## Conclusions

This is the first national survey of climate change and rural general practice in Aotearoa-NZ. While most respondents understood and agreed with basic climate change science, a concerning proportion remained unsure about climate science

and effects on health equity. Despite ample evidence, and prompting through a Māori model of health, many survey respondents did not recognize that climate change will further exacerbate existing Māori health inequities, or have particular effects on Māori wellbeing.

Current predictions of how climate change will affect health care provision include increased demand, especially primary care services, and an increasing burden on health care services responding to extreme weather events.<sup>20</sup> Our findings about the confidence of rural primary care staff in their service's ability to support communities through extreme weather events are similar to the findings from research in rural Australia.<sup>14</sup> As indicated in this previous research, participants in this survey made calls for additional resources and interagency collaboration to ensure adequate care to rural communities is preserved during and after an adverse weather event, especially in the context of community isolation postevent.

There were 2 other broad concepts presented by integration of the quantitative and qualitative findings. The first was that there was a lack of understanding of the health inequities that arise from climate change. The second was that forward planning appeared restricted to building clinical resilience rather than strengthening wider community and population health approaches. While participants identified a number of strategies to mitigate the impacts of climate change, these strategies focussed on improving practice resilience and responsiveness rather than fostering community resilience. Partnerships with iwi and central government leadership were given a low priority. Aotearoa-NZ has experienced a range of disasters over the last decade, including the Christchurch earthquake, White Island volcanic eruption and the Covid-19 pandemic. In each disaster, Māori hapū (sub-tribe) and iwi (tribe) responses facilitated disaster risk reduction and management for the whole community through the integration of Māori knowledge.<sup>8,21,22</sup>

Our findings are consistent with previous similar research, in that the impact of climate change, on rural communities, is already being felt, is extensive, and will exacerbate a wide range of health conditions in complex ways.<sup>4</sup> Further, rural general practice is increasingly responding to adverse weather events, and maintaining primary care services in the short-term aftermath as well as during longer-term recovery periods.<sup>20</sup>

Despite strong engagement, funding and support from the main professional rural general practice bodies, the study was limited by a low response rate. This is likely explained by the impact of Covid-19 and pressure on general practice as well as timing of the survey at the end of the year. However, the possibility exists that there is a low interest in climate change in rural general practice, and subsequently a low response. In addition, self-selection bias limits the generalizability of our findings, since participants may have been more likely to respond if they held strong views on climate change. Although the low response rate and self-selection bias limit generalizability for quantitative data, we consider that the mixed-methods study design nonetheless provides important insights for policy and future research. Further research is needed to determine whether these findings are generalizable to rural general practice internationally.

The findings suggest 4 policy recommendations. Although most participants largely understood the climate science and many were already currently experiencing many of the predicted effects of climate change within their communities, there is a persistent group of rural general practice staff in Aotearoa-NZ remaining unsure about climate science, climate change effects on health, and the effects on health equity, particularly for Māori. These gaps need to be addressed through targeted continuing professional development. Further assistance from professional bodies and central health agencies needs to be targeted to adequately prepare and resource rural general practice for adverse weather events. Improved local interagency cooperation is needed, with health and wellbeing at the heart of emergency preparedness. For Aotearoa-NZ, this would need to include strategies to facilitate partnerships between rural general practices and hapū and iwi to strengthen community resilience and further support Māori wellbeing. The role of primary care needs greater recognition by and facilitated involvement in existing cross-agency emergency response partnerships. Finally, general practice staff who recognize their role as local advocates for climate-related human health need more support, training and resourcing to take up that role. The relationships built with professional bodies and their support for this research demonstrates their willingness to hear and act on these policy recommendations.

These findings are relevant to rural and remote primary care practice in other high income countries facing similar service pressures. Adverse weather events causing rural community isolation will place a burden of care on the available rural health services in many areas. Climate change will cause increasingly complex health issues and worsened management of chronic health conditions. Globally, rural and remote primary care practices must prepare for increasing rural health service demand, as well as advocating for health- and equity-centred climate action.

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an Australian rural general practice survey developed by Drs. Rachael Purcell and Joe McGirr.<sup>14</sup> The authors would also like to acknowledge Te Rōpū Ārahi for their feedback into the survey design and theme development.

## Supplementary material

Supplementary material is available at *Family Practice* online.

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## Ethical approval

The study was approved by the Human Ethics Committee at the University of Otago (reference number D21/377).

## Conflict of interest

None declared.

## Data availability

Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data are not available.

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